International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN (P): 2250-2378; ISSN (E): 2319-4510
Vol. 9, Issue 5, Oct 2019, 643–656

SOLAR OPERATED AGRIBOT FOR GREEN HOUSE FARMING

Dr. PATIL NAGESH UMAKANT[1], Dr. SANDEEP TIWARI[2] & Dr. CHANDRAKANT KULKARNI[3]

[1, 3]Professor Jayawantrao Sawant College of Engineering, Savitribai Phule Pune University, Pune, India

[2]Krishna Engineering College, Ghaziabad, India

ABSTRACT

The idea for this research work is born out of concern for development of a multipurpose Agribot powered by non-conventional energy, hence economically viable for large section of farming community which is economically poor in India. Traditionally farming processes such as grass cutting, seed sowing, Ploughing and spraying are carried out one after the other using different types of equipment's thus consuming more energy and time, whereas Agribot combines all these operations in a single platform. And it reduces operating costs for the farmers. Our plan presents a system with high speed of operation for a sophisticated agriculture method that embody Grass cutting, Seed sowing, Sprinkling, Ploughing and a solar battery for battery charging. Mainly our robotic system is a mechanical device in nature that is steered by DC motor; the system is mounted on a frame with four wheels. Grass cutting, seed sowing, Ploughing and spraying work, take significant length of time. This approach reduces farmer's time and helps him to focus on cultivation and care of crops. Therefore, resulting in increase in farm efficiency by using multipurpose agricultural robot.We can remotely control this type of machine. An electrical device is utilized to charge the battery. An artificial language is utilized in programming the microcontrollers. The microcontroller is utilized to manage and monitor the tactic. This equipment is most suitable for farming of vegetable crops (for ex:-tomato, cucumber, Green-chills) grown in green house, where for the process of tilling, ploughing the power requirement is significantly lesser as compared to other farming processes.

KEYWORDS: Agribot, Agricultural Mechanism & Machine-Driven Agriculture Farming

Received: Jul 05, 2019; **Accepted:** Jul 25, 2019; **Published:** Sep 21, 2019; **Paper Id.:** IJMPERDOCT201956

Original Article

1. INTRODUCTION

India is an associate agriculturalcountry wherever inadditional than 75% of individuals depend upon Agricultural financial gain for his or her living. In agriculture, some monumental streams and activities are performed by the farmers in routine. historically, these activities are performed manually by the farmers. Agriculture is main profession of rural India and it is suitably called backbone of Indian economy. The ever increasing demand for larger quantity of qualitative agricultural produce necessitates further research in the area of design and development of farming equipment, an effort towards this goal is Development of "multipurpose Robot" which combines four diffreent applications which are Grass cutting, Ploughing, Seed sowing and Sprinkling. These applications confirm that the time needed for farming operations is a smaller amount than standard strategies. An Automatic mechanized equipment is the need of our, that is found in Multipurpose Agribot which can programmed according to the functional requirement and also it can be remotely controlled. By using wireless remote which actuates Microcontrollers, we operate the Agribot. There are four ways to control the operation namely grass cutter, plough sprinkler and seed sowing mechanism. Hydraulic jack operates ploughing mechanism and for the sprinkler liquid under high pressure is provided with the help of pump. Agribot in real time application saves money and

time. Safety for operators is better when Agribots which are remote controlled are used.

Following are the key activities concerned in farming

- Harvesting
- Winnowing
- Threshing
- Weeding
- Spraying

2. PROBLEM STATEMENT

Farmers face problems during theirwork, such as ploughing, spraying the pesticides, sowing the seeds and grass cutting. Independently managing these activities is expensive and therfore burden to the them. Agribot performs these activities in a minimum possible timewith better efficiciency at lower costs.

3. METHODOLOGY AND IMPLEMENTATION PERSPECTIVES

The outline above, demonstrates the rundown gathering of Agribot. It affirms the areas of different application mounted on the frame, consisting of the following objectives:-

- Design of Agribot is considered after studying farming land and crop.
- Design and selection of various components of Agribot.
- Development of Seeding, Sprinkler, Ploughing and Grass cutting mechanism.
- Fabrication and assembly.
- Testing of Robot.
- Results.
- Conclusions.
- Future Scope.

The diagram represents the overview assembly of our Agribot. It consists of different parts (Grass cutter, sprinkler, seed sowing & Plough) which are placed on the chassis of the Agribot. The grass cutter mechanism is placed at the front portion of the chassis and the ploughing mechanism is placed at the back end of the chassis. The Seed sowing mechanism is near the ploughing mechanism but it is on the chassis and the sprinkler mechanism is near the grass cutter mechanism on the chassis. The Solar panel and the battery are mounted in between the Seed Sowing and Sprinkler mechanism.

- **Ploughing:** This application isincredibly simply achieved by attaching the metal like structure at the rear aspect of the automaton. For this application, we tend to be needed to relinquish ample mechanical strength to the automaton, as a result, it's significant and once its place on soil for tilling purpose, it needs additional power to manoeuvre forward. this is often the initial operation within the farm. This application has no delay time. Once it places on the farm it unendingly ploughs the soil with the cultivation tool that's high-powered by on 12V DC.

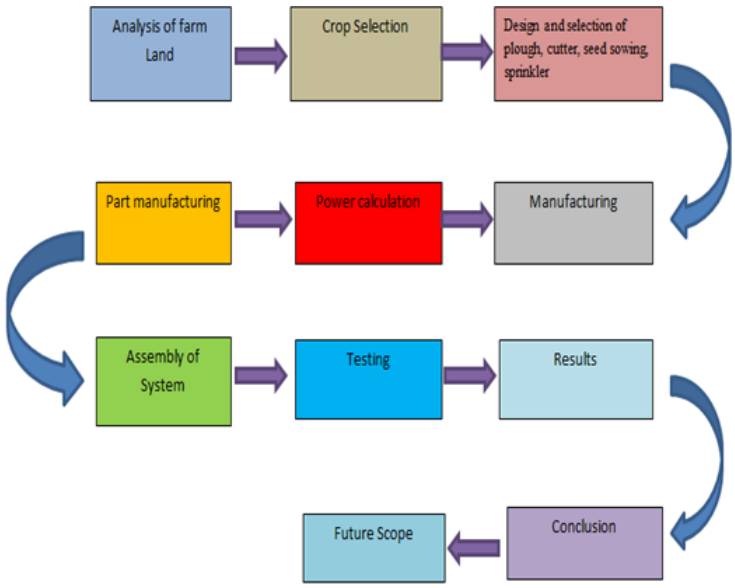
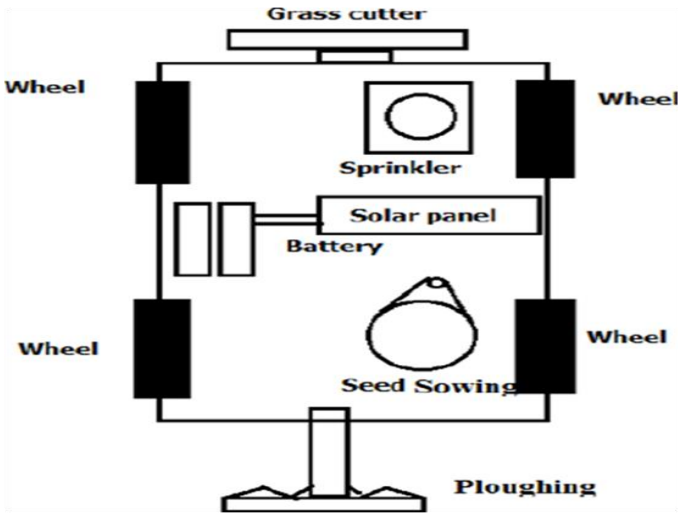


Figure 1: Methodology of Agribot.



Figur 2: Schematic Diagram of Agribot.

- **Seed Distribution:** The operation of seed dropping is completed done by the dc motor mechanism. For that, we tend to use the special mechanical head at the shaft of the dc motor. This DC motor is hooked up with a funnel at the rear aspect of the automaton. The purpose on the farm wherever we wish to drop the seed. The dc motor vibrates the receptacle, because of this vibration seeds area unit born from the funnel and a skinny atomic number 13 sheet is mounted below the opening of the funnel to manage the number and density of the seeds. during this means the dominant action of motor takes that helps in equal distribution of seeds.

- **Sprinkler:** A separate irrigator within the variety of a mechatronic mechanical device was developed to use variable rates of water once the soil is dry. The flight and sector angles of the jet were controlled by the AVR controller. A wetness device is connected with this computer which may sense the condition of the soil and provides a command to the pump to produce the water.

- **Grass Cutter:** The solar operated Lawn mower is a fully operated and automated cutter.

3.1. Remote Controller

We are using the remote controller for controlling or giving the input to the microcontroller 8051. We are using the push button on the remote controller.

3.2. 8051 Microcontroller

We are using the 8051 Microcontroller as intermediate device which takes the input from the remote

3.3. Receiver Robot

Controller sends signals to the RF module. We are using this Microcontroller because it is simple to use as lesser cost

3.4. RF Module Transmitter

We are using the RF module to transmit the wireless signal to the RF module receiver which is fixed on the robot assembly. It takes the signal from the mc and sends to the robot.

3.5. RF Module Receivers

RF module works with the Radio Frequency. The range of the RF module is from 30 kHz to 300 GHz. The signal transmitted through the RF module is best than IR due to several reasons. The signals from the RF will travel through larger distances creating it appropriate for long vary applications. Also, where as IR principally operate in line-of-sight mode; RF signals will travel even once, there's Associate in nursing obstruction between transmitter & receiver. Next, RF transmission signal when compared with IR transmission is stronger and reliable. RF communication uses a particular frequency in contrast to IR signals in that area unit as alternative IR emitting sources. The RF module is split into 2 modes that area unit, Transmitter Section and Receiver Section. The operation of transmitter or receiver happens at a frequency of 434 rates. A RF transmitter receives information in the form of serial and then transfers the information (wirelessly) with the help of RF antenna which is connected to a pin four. The transmission travels at a speed of 1Kbps to 10Kbps. The transmitted signal data is accepted by RF receiver which operates as an identical frequency like that of transmitter. We can use the RF module receiver on the automaton to achieve the wireless signals that square measure sent from the RF module transmitter. Microcontroller then receives the next updated signals.

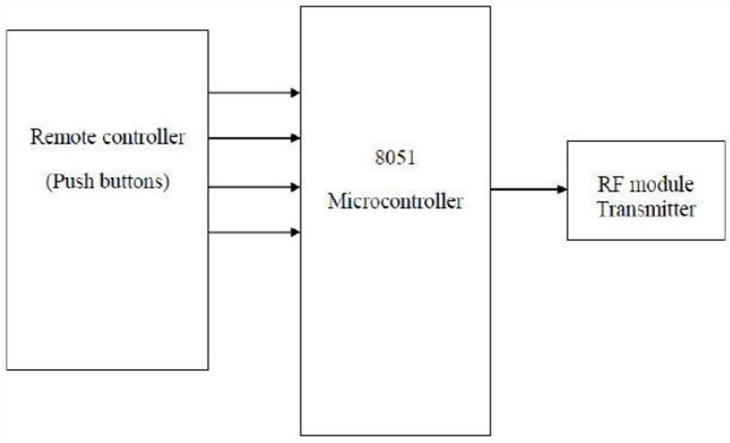


Figure 3: Transmitters.

3.6. L293D Motor Driver

It is used to drive the motor in either direction. It is connected to all the DC motors which are connected to the Robot, Grass Cutter and Sprinkler.

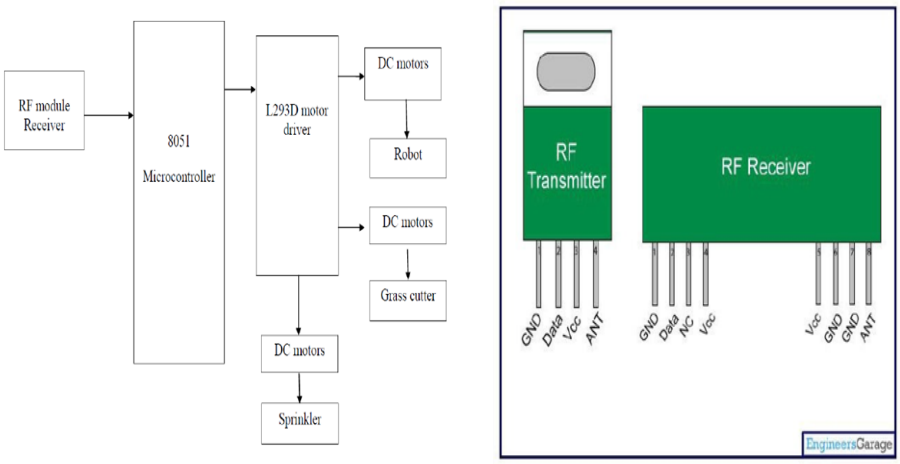


Figure 4: Receivers.

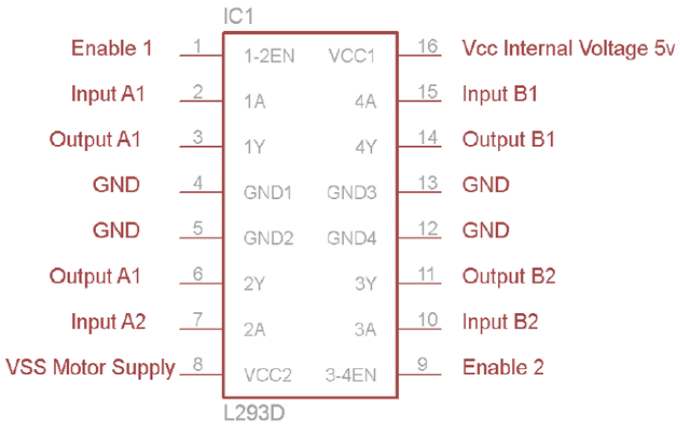


Figure 5: L293D Motor Driver Circuit.

3.7. Micro-Controllers

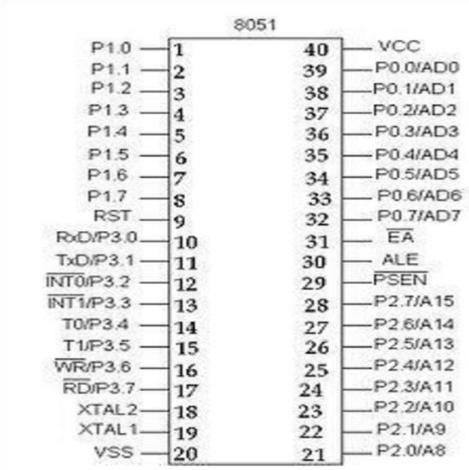


Figure 6: Microcontrollers 8051.

We are using Microcontroller which is easy to use and has following features:

RF module will shift from thirty kilo-cycles to 3 hundred Giga cycle. The transmission of a symbol through the RF module is healthier than IR (Infrared Rays) on account of many reasons.

Right off the bat, flag through RF can bear larger separations creating it correctly for long and completely different applications. IR works in a very visible pathway. RF transmission is powerful and dependable than IR transmission. RF correspondence utilizes a selected return as critical IR flag. Transmitter Section and Receiver Section are the two components of modes of an RF module. The transmitter/collector works at a return of 434 megacycles. RF transmitter receives continuous data signal and transmits it to RF which consist of a pin4. The speed of transmission takes place at1Kbps to 10Kbps. The transmitted learning is received by RF beneficiary in activity at a comparable return as that of the transmitter.

4. DESIGN CONSIDERATION

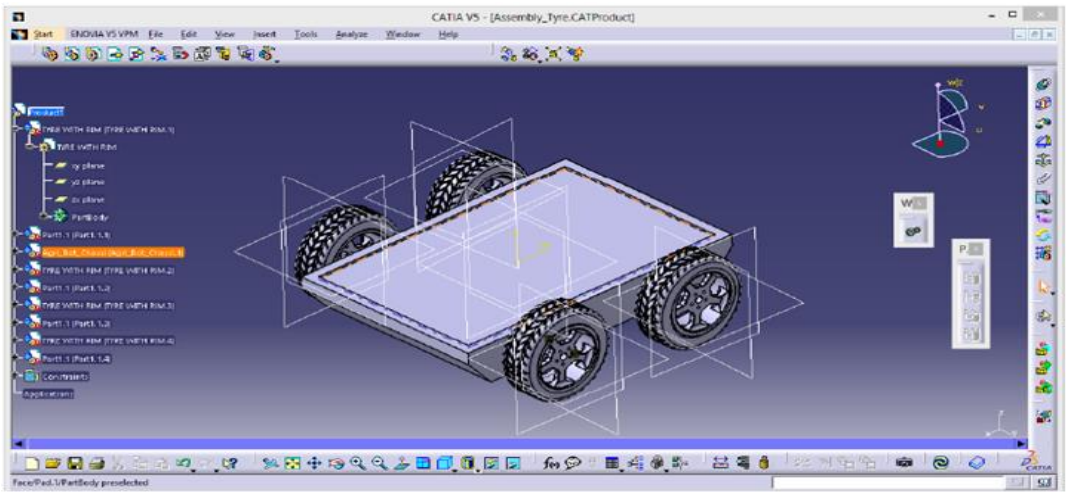


Figure 7: CAD Model of Chassis.

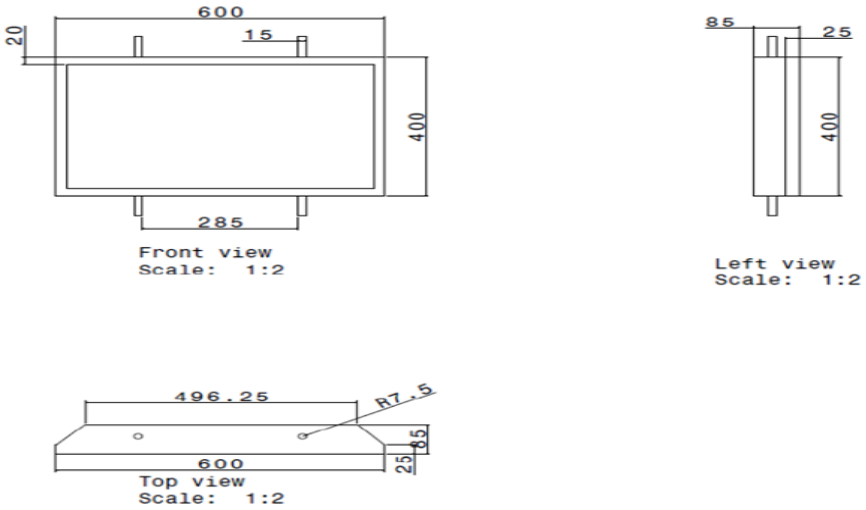


Figure 8: Drafting Model of Chassis.

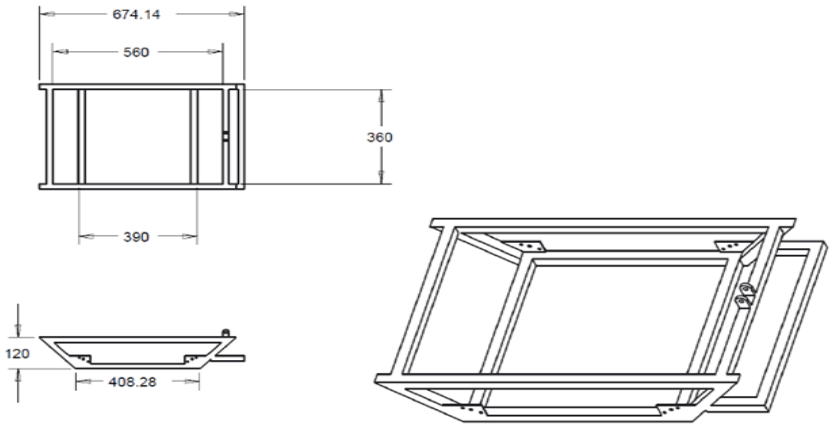


Figure 9: Frame View 2D.

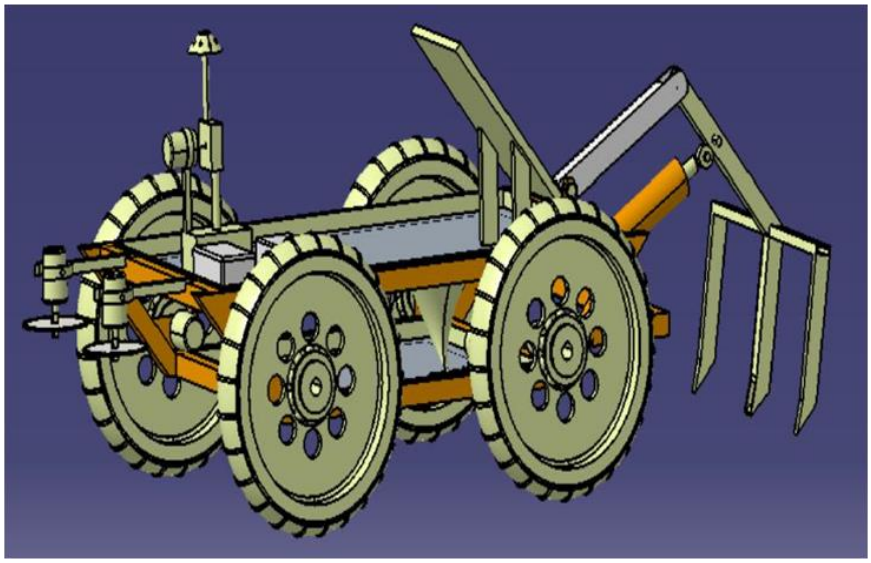


Figure 10: Agribot Assemble View.

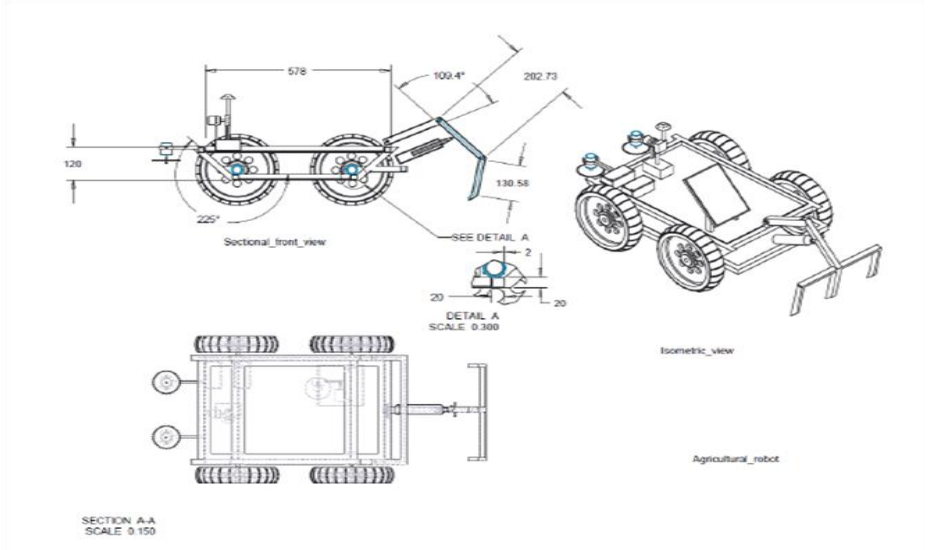
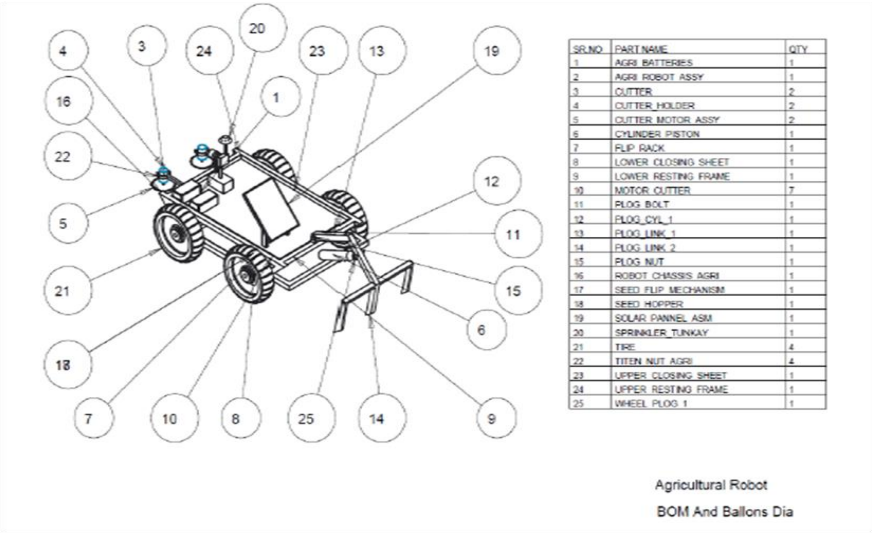


Figure 11: Cut Section with Isometric View.



SR.NO	PART NAME	QTY
1	AGRI BATTERIES	1
2	AGRI ROBOT ASSY	1
3	CUTTER	2
4	CUTTER HOLDER	2
5	CUTTER MOTOR ASSY	2
6	CYLINDER PISTON	1
7	FLIP RACK	1
8	LOWER CLOSING SHEET	1
9	LOWER RESTING FRAME	1
10	MOTOR CUTTER	7
11	PLOG BOLT	1
12	PLOG CYL 1	1
13	PLOG LINK 1	1
14	PLOG LINK 2	1
15	PLOG NUT	1
16	ROBOT CHASSIS AGRI	1
17	SEED FLIP MECHANISM	1
18	SEED HOPPER	1
19	SOLAR PANNEL ASM	1
20	SPRINKLER TUNKAY	1
21	TIRE	4
22	TITEN NUT AGRI	4
23	UPPER CLOSING SHEET	1
24	UPPER RESTING FRAME	1
25	WHEEL PLOG 1	1

Figure 12: Bom And Ballon Diagram.

5. EXPERIMENTAL SETUP AND FLOW

The instrument consists of following components. Keyboard, microcontroller & battery are shown in above diagram. The remote transmitter transmits the signal. This signal is received by a system that fills in as a collector by the microcontroller. As the system detect a signal with electric circuit from DC engine that can impel the engines which get activated. Agribot's wheels are controlled in pair independently in front and rear of the equipment. Wheels can move in forward, left, right and rear directions. When the bearer of the system goes into the field, the component showers the fluid on the harvests. During this process grass cutter can be made inactive by a simple switch.

The circuit diagram of wheel drive is shown above. Agribot consist of four wheels which are connected separately with four motors to four wheels with the same specification. Agribot consists of total 4 motors, there are two L293D driver IC, each of which are connected with 2 motors

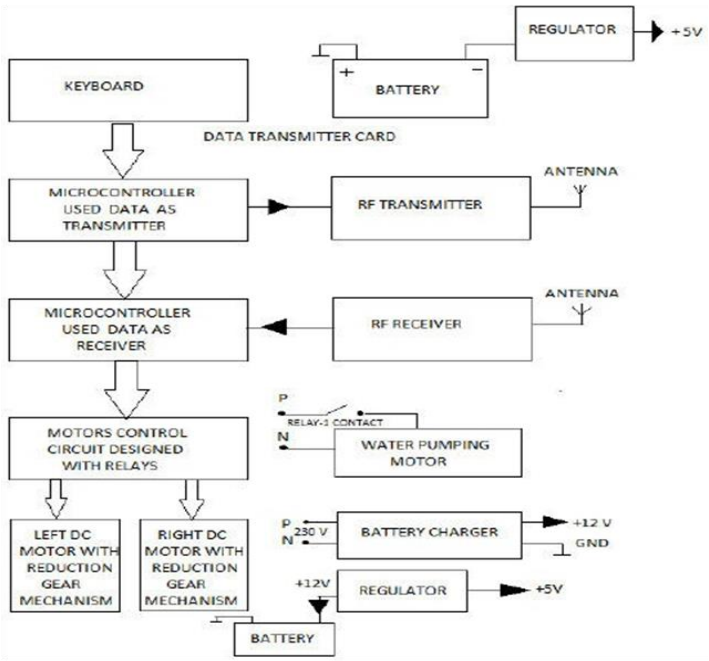


Figure 13: Setup Block Diagram.

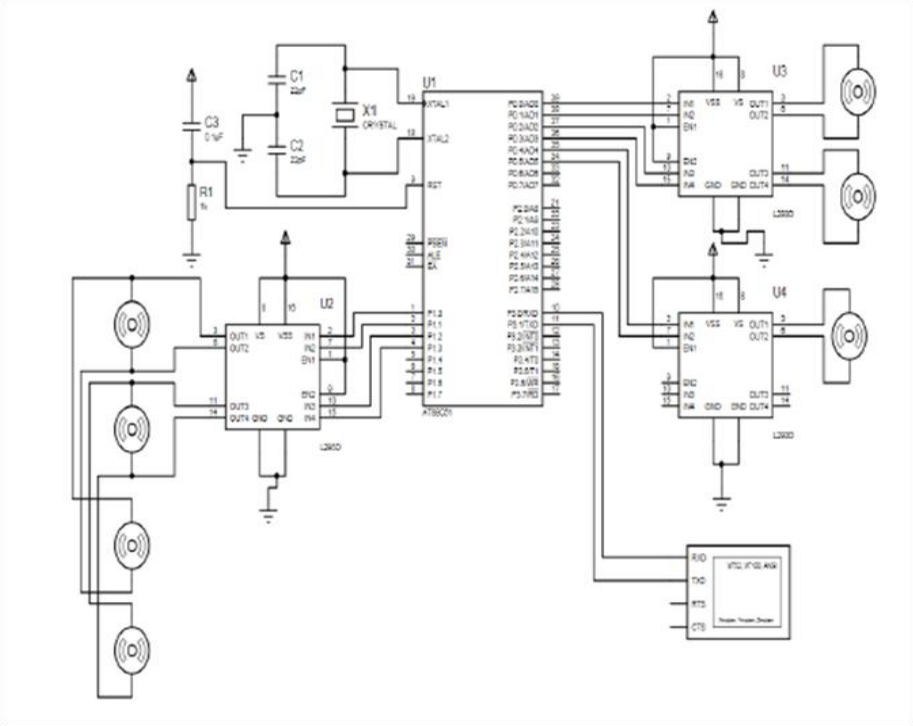


Figure 14: Circuit Diagram of Whole Agribot.

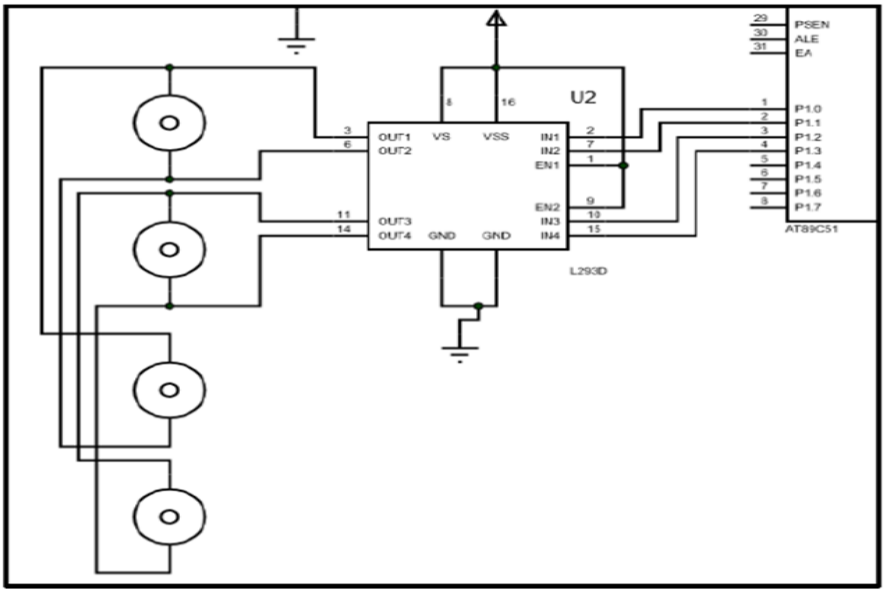


Figure 15: Wheel Drive Circuit Diagram.

6. MATERIAL AND SPECIFICATIONS

Table 1: Material and Specifications

Material	Specification
Motors for wheels	250 rpm and high torque
motors for cutter	High rpm
Motors	65 rpm,
Sprinkler Assembly	Compressed pump, plastic tank .05 lit, sprinkler

Table 1: Contd.,	
Wheels	20 cm
Chassis	Mild steel chassis
Cutter	2, 12 cm diameter
Seed sowing mechanism	nozzle type
Ploughing	Movable Hydraulic/injection system/hydraulic system
Solar panel and charging assembly	Two batteries of 12 v charging done in 2 days
RF transmitter and receiver	2.4 Gz 6 channel
General assembly	NA
Microcontroller, wires	AVR Microcontroller controller
Patch cots and connector assembly	NA
Rack and pinion arrangement	Metallic
Battery (Receiver side)	24 v rechargeable
Cells (Transmitter side)	A +

6.1. Mechanical Properties

Table 2: Mechanical Properties

Mechanical Properties	Metric
Hardness, Brinell	130
Hardness, Knoop (Converted from Brinell hardness)	147
Hardness, Rockwell B (Converted from Brinell hardness)	73
Hardness, Vickers (Converted from Brinell hardness)	135
Tensile Strength, Ultimate	445 MPa
Tensile Strength, Yield	375 MPa
Elongation at Break (In 50 mm)	16.0 %
Reduction of Area	42.0 %
Modulus of Elasticity (Typical for steel)	208 GPa
Bulk Modulus (Typical for steel)	142 GPa
Poissons Ratio (Typical For Steel)	0.295
Machinability (Based on AISI 1212 steel. as 100% machinability)	71 %
Shear Modulus (Typical for steel)	81.0GPa

6.2. Electrical Properties

Table 3: Electrical Properties

Electrical Properties	Metric	Comments
Electrical resistivity @0°C (32°F)	0.0000160 Ω-cm	annealed condition
100 °C/ 212 °F	0.0000218 Ω-cm	annealed condition
200 °C/392 °F	0.0000298 Ω-cm	annealed condition

6.3. Physical Properties

Table 4: Physical Properties

Physical Properties	Metric
Density	7.89g/cc

6.4. Weld Ability

Attachment isn't counseled for AISI 1018 mild/low steel once it's carbo-nitrided and carburized. Low carbon attachment electrodes measure to be employed in the attachment procedure and post heating and pre heating aren't necessary. For fifty metric linear unit pre heating will be performed over sections post welding stress has its own useful aspects just like the pre heating method when compared.

6.5. Heat Treatment

The heat treatment for AISI 1018 mild/low carbon steel consists of the following processes:

6.6. Normalizing

AISI 1018 mild/low carbon steel should be heated at 890°C – 940°C and then cooled in still air.

6.7. Forging

This method needs heating between 1150°C – 1280°C and AISI 1018 mild/low steel is command till the temperature becomes constant,900°C is that the minimum temperature needed for the shaping method.

6.8. Tempering

AISI 1018 mild/low steel is tempered at between 150°C – 200°C for improvement of case toughness. This method has very little or no result on hardness. The prevalence of grinding cracks is reduced once AISI 1018 mild/low steel is tempered at the on top of mentioned temperature.

6.9. Annealing

The AISI 1018 mild/low steel is heated at 870°C – 910°C and allowed to chill during a chamber.

6.10. Stress Relieving

The temperature range in the case of AISI 1018 mild/low steel is at 510°C – 700°C.

6.11. Case Hardening

This methodology desires heating to be done between 780°C – 820°C. AISI 1018 mild/low steel is then quenched in water.

6.12. Core Refining

This is associate facultative method that needs heating at 880°C – 920°C. AISI 1018 mild/low steel when being heated is moistened in oil or water.

6.13. Carburizing

Temperature range varies from 880°C – 920°C for Carburizing to occur.

7. CONCLUSIONS

The advancement in agricultural processes, it is essential that, a multipurpose device that can perform various farming activities needs to be developed, Agribot developed by us fulfills this requirements. This instrument empowers the farmer to efficiently perform various farming tasks, thus saving time and energy, at the same time reducing the operating costs. Use of mechanized instruments like Agribot not only reduces the overall costs of operations but also does not have any negative effect on the health of farmers. Automation reduces possibilities of accident in the field operations.

REFERENCES

1. *CeresR, PonsJL, JimenezAR, Martin JM, CalderónL. Agribot: A robot for aided fruit harvesting. Industrial Robot.1998; 25(5):337–46.*

2. *Abhang, P., Manasi, P., & Pramod, M. (2015). Beneficial effects of Agnihotra on Environment and Agriculture. International Journal of Agricultural Science and Research (IJASR).*
3. *Shivaprasad BS, Ravishankara MN. Design and implementation of seeding and fertilizing agriculture robot. International Journal of Application or Innovation in Engineering &Management (IJAIEM). Jun; 3(6):251–5.*
4. *Gholap Dipak Dattatraya1, More Vaibhav Mhatardev, Lokhande Manojkumar Shrihari, Joshi BE [E&TC], Vishwabharati Academy's College of Engineering, Pune university, Ahmednagar, Maharashtra, India, Vishwabharati Academy's College Of Engineering, Pune university, Ahmednagar, Maharashtra, India, 2015.*
5. *Chakraborty, S., & Acharya, S. K. (2018). Disillusionment, Dissonance and Entropy Amidst Indian Agriculture: The Reflection and Refraction. International Journal of Applied and Natural Sciences (IJANS) ISSN (P), 2319–4014.*
6. *Swati D. Sambare, S.S. Belsare Dept. of Electronics BVDUCOEP Pune, India [Volume||3||Issue||5||Pages|| 2889–2892||2015|]*
7. *P. Usha, V. Maheswari, Dr. V. Nandagopal, Department of Electrical and Electronics Engineering GanadipathyTulsi's Jain Engineering College, Vellore,2015*
8. *Kumar, S., Singh, R., Rao, D. U. M., Kumar Gupta, S., & Sharma, S. (2017). Knowledge Management in Agriculture: A Critical Analysis. IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS), 5(11), 19–26.*
9. *Amrita Sneha, Abirami, Ankita, Mrs. R. Praveena, Mrs. R. Srimeena, Department of Electronics and Instrumentation Engineering Easwari Engineering College, Chennai, Tamil Nadu, India. 2015 IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR 2015), 978-1-47997758-1/15.*
10. *Abdul-Rahman, A. M. (2016). Subsidence of Acute Poisoning in Children Using Pesticide Accidentally in Agriculture Region and Study Their Response to Atropine. International Journal of Medicine and Pharmaceutical Science (IJMPS) ISSN (P), 2250–0049.*
11. *R. Joshua, V. Vasu and P. Vincent "Solar Sprayer - An Agriculture Implement International Journal of Sustainable Agriculture" 2 (1): 16-19, 2010 ISSN 2079-2107 © IDOSI Publications, 2010.*
12. *MitulRaval, Aniket Dhandhukia and Supath Mohile "Development and Automation of Robot with Spraying Mechanism for Agricultural Applications" International Journal For Research In Emerging Science And Technology, Volume-2, Issue-8, Aug-2015.*
13. *Barua, S., Kumar, R., Satyapriya, S., Singh, P., & Muralikrishnan, L. (2017). Climate Change and Its Projected Impact on Agriculture and Allied Sector: The Facts We Should Know. Available at SSRN 3094268.*
14. *Agriculture Output Report from IMF and CIA World Factbook, 2015.Ceres R, Pons JL, Jimenez AR, Martin JM, Calderón L. Agribot: A robot for aided fruit harvesting. Industrial Robot. 1998; 25(5):337–46.*
15. *Shivaprasad BS, Ravishankara MN. Design and implementation of seeding and fertilizing agriculture robot. International Journal of Application or Innovation in Engineering & Management (IJAIEM). 2014 Jun; 3(6):251-5.*
16. *Zenkhri, S., Kouri, L., Karabi, M., Kemassi, A., & El-Hadj, M. D. O. (2015). Agriculture Saharan (Algeria): importance, characteristics and elements for a better management. International Journal of Agricultural Science and Research (IJASR), 5(4), 247–253.*

AUTHORS PROFILE

Dr. Patil Nagesh Umakant is the Assistant Professorof Jayawantrao Sawant College of Engineering. Dr. Patil Nagesh Umakant carries anexperience of leading in various capacities such as Department NAAC criteria 5 coordinator, Guest Lecture for ME students in D.Y.Patil, Quality Assurance Cell Member. I have been serving in education for more than 7 years, spent initial six months in gaining industrial experience.

As an Assistant Professorof the college, Dr. Patil Nagesh Umakant has immensely contributed to the overall growth of the college and has helped various projects scale new heights.

He is a Ph.D. degree holder in the field of Mechanical Engineering from Shri Venkateshwara University U.P; the research was carried out at JSCOE, Pune. A Master of Engineering degree from Dayanada Sagar College of Engineering, VTU University, Belgaumbacked by Bachelor of Engineering degree from BLD College, VTU University, speaks for itself and augments his extensive knowledge. Along with this, he also holds many publications in National & International journals and conferences under his name.

I have also guided both UG and PG students during my academic experience. I have also filed and Published Two patents during my academic carrier. I have also received Best teacher award by All India Folk & Tribal Art Parishath. (ANNA HAJARE AWARD). I have also received Letter of appreciation from Asian Association for Agriculture Engineering for Reviewing.

Dr. Sandeep Tiwari is the Director of Krishna Engineering College. He is a seasoned leader and a learned academician who brings proven expertise in Research, Academics and Industry. With a career spanning over 25 years, Dr. Tiwari carries a rich experienceof leading in various capacities such as Director, Head of the Department, Professor, Engineer and Researcher. He has been serving in education for more than 19 years, spent initial five years in gaining industrial experience.

As the Director of the college, Dr. Tiwari has immensely contributed to the overall growth of the college and has helped various projects scale new heights. He joined Accurate Institute of Management and Technology, Greater Noida, as Professor and Head of Mechanical Engineering fortwo years however, within a short span of one year he progressed and attained the position of the Director. Prior to joining the institute, he also worked as Professor and Head of Mechanical Engineering Department at the College of Engineering and Technology, IILM-AHL. In addition to that, he had also served as Associate Professor, Assistant Professor and Reader at various pioneer Engineering Institutes.

He is a Ph.D. degree holder in the field of Mechanical Engineering from Technical University of Uttar Pradesh however; the research was carried out at Indian Institute of Technology (BHU), Varanasi. A Master of Engineering degree from Indian Institute of Technology, Roorkee backed by Bachelor of Engineering degree from Karnataka University, Dharwad speaks for itself and augments his extensive knowledge. Along with this, he also holds many publications in National & International journals and conferences under his name.

As part of his Industrial experience, Dr. Tiwari worked and gained enormous understanding as a Production Engineer with two renowned companies namely, Tribhuvan Steel Industries Limited, Lucknow and Subhash Projects and Marketing Limited, Delhi.

With this record of affluent Academic and Industry experience, time and again, he's been conferred crucial roles of the Head Examiner and Observer by various Government Examination bodies.

Dr. Chandrakant Kulkarni is the Director of Quality Assurance Cell Jayawantrao Sawant College of Engineering. He is a seasoned leader and a learned academician who brings proven expertise in Research, Academics and Industry. With a career spanning over 25 years, Dr. Chandrakant Kulkarni carries a rich experience of leading in various capacities such as Director, Head of the Department, Professor, state squad special officer, chairman squad committee. He has been serving in education for more than 25years, spent initial 1yearin gaining industrial experience.

As the Director of the college, Dr. Chandrakant Kulkarni has immensely contributed to the overall growth of the college and has helped various projects scale new heights. Prior to joining the institute, he also worked as Lecturer in Guru Nanak Dev Engineering College, Bidar, as Lecturer to Professor he has completed over23years however, within a long span of 23yearshe progressed and attained the position of the Director. In addition to that, he had also served as Associate Professor, Assistant Professor and Reader at various pioneer Engineering Institutes. He joined the institute as a Professor and became Director QAC.

He is a Ph.D. degree holder in the field of Mechanical Engineering from NIMS University of Rajastan, Varanasi. A Master of Engineering degree From B.E.C Bagalkot (Karnataka University), backed by Bachelor of Engineering degree from BMS College of Engineering, Bangalore, Bangalore University, Bangalore speaks for itself and augments his extensive knowledge. Along with this, he also holds many publications in National & International journals and conferences under his name.

As part of his Industrial experience, Dr. Chandrakant Kulkarnii worked and gained enormous understanding as a Production Engineer.